THE COURTSHIP BEHAVIOR OF THE BEE FLY *MEOMYIA VETUSTA* WALKER (DIPTERA: BOMBYLIIDAE)

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Abstract

Observations are provided on the courtship behaviour of *Meomyia vetusta* Walker in southeastern New South Wales, Australia.

Introduction

The Bombyliidae are a species rich, globally distributed group of brachyceran flies (Yeates 1994). Little is known of the life histories and behavioural biology of the Australian species, although there are many records of parasitism by non-Australian bombyliid larvae (Hull 1973, Yeates and Greathead 1997). Dodson and Yeates (1990) and Yeates and Dodson (1990) studied the territorial, hill-topping behaviour of male *Comptosia tutela* Yeates in southeastern Queensland. During these studies, a male was seen to intercept a female within a male territory, in mid-flight, achieving tail-to-tail copulation without displaying any overt courtship behaviour (Yeates and Dodson 1990). Toft (1989a, b) studied male *Lordotus pulchrissimus* Williston swarming behaviour and interactions with females in Californian sand dune environments; again courtship behaviour was not observed although the species copulates in mid air. Thus, bombyliid courtship behaviour, in territorial and swarming species at least, seems to consist of a simple mid-air intercept, grapple and copulation. This behavioural pattern is also common in many species of Lower Diptera such as Chironomidae, where the males form swarms and the females visit the swarms and copulate immediately with males in mid air (Downes 1969).

Colless (1977) observed a female *Anastoechus* sp. apparently displaying ovipositing behaviour on the floor of a sandstone overhang in the Bukalara Plateau, Northern Territory; however, this was most likely sand gathering rather than actual oviposition (Yeates 1994). One of us (DJF) observed the courtship behaviour of *Meomyia vetusta* Walker (Fig. 1) in sand dunes in southeastern New South Wales and this is reported here. To our knowledge, this species does not form hilltop aggregations, swarms or leks and the series of behaviours leading up to copulation is much more complex than previously reported for *Comptosia* or *Lordotus*.

The geographic distribution of *Meomyia vetusta,* determined from specimens in the Australian National Insect Collection (ANIC), is from southeastern Queensland to the Victorian border, mostly along the coast, with several specimens taken at higher altitudes along the Great Dividing Range. Adults fly from August to December in the northern part of the range and from October to December towards the southern end of the range.

Fig. 1. *Meomyia vetusta* (ANIC_29:029405) female, collected on the same day at the same location as the observations reported here. Scale = 5 mm.

Observations

Observations were made in a sand dune environment adjacent to Broulee Island, southeastern New South Wales (35°51'S 150°10'E), on the morning of 1 October 2012. Weather conditions were calm, 15°C at 0900h and under a cloudless sky.

The first courtship observation was at approximately 0930h and was detected through a loud buzzing noise produced by the male, which was hovering just in front of a motionless female resting on the tip of a leaf of *Lomandra longifolia* (Xanthorrhoeaceae). The male was slowly hovering in an arc of approximately 45° directly in front of the female and in the same horizontal plane. The male was also actively touching the female's proboscis with his throughout this hovering flight behaviour. After approximately 90 seconds the female took flight, when the male intercepted and grappled with her in mid air, achieving a tail-to-tail copulating position before the pair flew away. Both male and female were netted and vouchered in ANIC.

The second observation occurred at around 1000h, when a female, flying slowly approximately 30 cm above the ground, passed over a resting male. The male immediately flew rapidly to intercept the female, bumped into her, then dropped below and behind her, keeping a distance of about 15 cm. The male followed the female for about 20 m until she landed on the end of an *L. longifolia* leaf. Consistent with the previous observation, the male then produced a loud buzzing sound, which was louder and of a different pitch to the sound produced when flying normally. This loud buzzing sound was produced while the male hovered left and right of the motionless female in an

arc of approximately 45°, and while the male actively touched his proboscis against the female's. This continued for approximately a minute, until the female took flight, when the male then intercepted and grappled with the female, achieving a tail-to-tail copulation in mid air. The pair then flew a short distance away before landing and remaining in copula.

Discussion

The two observed courtships, involving different pairs, were consistent and suggest the following series of six behaviours, by both male and female, leading to copulation in *Meomyia vetusta*:

1. The female flies slowly near the ground in the vicinity of the resting male.

2. Once within range, the male intercepts the female in flight and grapples with her.

3. The female continues flying while the male drops to a position behind and below the female, separated by a distance of approximately 15 cm.

4. The pair fly in unison for a few metres, then the female lands while the male hovers directly in front of her.

5. The male touches the female's proboscis with his proboscis, while slowly hovering in an arc of approximately 45° directly in front of the female in the same horizontal plane. The female remains motionless during this stage. While hovering, the male also produces a distinct, loud, buzzing sound with his wings. This stage lasts 60-90 seconds.

6. The pair fly upwards, the male intercepts the female and grapples with her before quickly achieving a tail-to-tail copulation position, the pair then flying briefly together before landing to remain in copula.

Stage 5 is clearly the most complex and unusual and not previously described in Diptera. No fluid transfer or nuptial gifting was observed between the sexes during this stage, but remains a possibility and does occur in other flies (Marshall 2012). The mechanism of sound production during stage 5 is unknown, but presumably involves a change in the attitude of the wings as the insect hovers. The series of behaviours elicited by both sexes leading up to copulation in *Meomyia vetusta* shows that the courtship behaviour of bee fly species that do not swarm or lek may be very complex.

Acknowledgement

We thank Cate Lemann, CSIRO Ecosystem Sciences for the photograph.

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